

DEPARTMENT OF MATHEMATICS

Report to the Board - Spring 1998

PERSONNEL

Roger Lautzenheiser is on sabbatical leave at Kanazawa Institute of Technology in Ishikawa, Japan and **John Rickert** is on sabbatical leave at Pennsylvania State University. Both professors are teaching and working with research colleagues at their host institutions.

STUDENT ACTIVITIES, PRESENTATIONS, PUBLICATIONS and AWARDS

Student Presentations

Mike Pilcher, “Statistical Analysis of Air Bag Controllers”, *Pi Mu Epsilon Conference at Miami University*.

Jamie Kawabata, “p-adic Integrals”, *Pi Mu Epsilon Conference at St. Norbert College*.

Joshua Horstman, “Meeting, Bloody, Meetings”, *Pi Mu Epsilon Conference at St. Norbert College*.

Matt Lepinski, “Cwatsets: Examples and Conjectures: Part I”, *RHIT Undergraduate Mathematics Conference*.

Stuart Light, “Cwatsets: Examples and Conjectures: Part II”, *RHIT Undergraduate Mathematics Conference*.

Courtney Lewis, “Automation of the Hanging Resonant Chain Experiment”, *RHIT Undergraduate Mathematics Conference*.

Jim Meyer, Fred Franzwa, Jonathan Matthews, “A Skewed Perspective”, (Modeling Competition Presentation), *RHIT Undergraduate Mathematics Conference*.

Conferences attended :

Pi Mu Epsilon Conference at Miami University: 2 students

Pi Mu Epsilon Conference at St. Norbert College: 2 students

Spring Meeting of the Indiana Section of the MAA, Ball State: 14 students

Mathematics Competitions

7th Annual Alfred R. Schmidt Freshman Mathematics Competition Dennis Lin was the overall winner among 24 students who participated in the seventh running of this contest. Organizers: Professors Berzsenyi, Bryan, Hopkins, Rader and Shibberu.

19th Annual Virginia Tech Regional Mathematics Competition Two students, Brooke Chenoweth and Matt Lepinski, from the 13 Rose students participating in this contest, were in the top 10% of 170 contest participants from 31 schools. This was our second year of participation. Organizers: Allen Broughton and Dave Rader.

58th Annual Putnam Competition: The team of Ben Ford, Josh Horstman and Jamie Kawabata ranked 63rd out of 314 schools. David Powder, Randy Motchan and Matt Lepinski placed in the top 500. Advisor: Steve Carlson.

14th Annual Mathematical Contest in Modeling All three teams from Rose-Hulman earned high recognition among 472 teams representing 8 different countries including USA, China, Australia, Canada, Finland, Hong Kong, Ireland, and Lithuania. This is a difficult, tiring (both mentally and physically) competition, and successful completion with any designation is a great achievement. The teams of Jonathan Matthews, James Meyer, and Fred Franzwa and the team composed of Joshua Horstman, Jamie Kawabata, and Matthew Lepinski both won Meritorious designations for their work on an image processing problem and a fair class rankings problems in colleges, respectively. This designation placed both in the top 17% of all competitors. The first team made a presentation of their results as noted below. The team of Dennis Lin, Christopher Cole, and Benjamin Ford also worked on the image processing problem and received an Honorable Mention, placing them among the top 43% of all competitors. Advisors: Aaron Klebanoff and Frank Young.

33rd Indiana College Mathematics Competition The team of Kyle Lacey, Matt Lepinski, and Randy Motchan claimed second prize in the contest. Two of the other four Rose teams placed in the top 8 of 29 teams participating. Advisors: Steve Carlson and Aaron Klebanoff.

Awards: During the Spring Honors and Awards Banquet, **Dennis Lin** was awarded the Palmer Award for outstanding performance as a freshman. **Josh Horstman, Jamie Kawabata, and Patrick Swickard** were awarded the Sousley Award as outstanding graduating mathematics seniors. Fifteen other students were recognized for their achievements in the various mathematics competitions, described above. **Richard Mohr** a '96 grad was awarded the Andree Prize of \$300 for his writing in the Pi Mu Epsilon Journal. Two mathematics alumni, **Doug Zapp**, 1972 and **Doug Roof**, 1969, were inducted into the RHIT Hall of Fame as former students/athletes.

Pi Mu Epsilon Thirty students and faculty members attended the Annual Pi Mu Epsilon Banquet on April 28. Thirty-one of the Rose-Hulman student body were inducted into Pi Mu Epsilon, an honorary mathematics fraternity. Dr. John Emert of Ball State spoke on Wild Card Poker.

Study Abroad Physics/Math double major Chris Prince spent the first two quarters studying in Limerick, Ireland.

FACULTY and STAFF ACTIVITIES

Nacer Abrouk In addition to teaching undergraduate statistics courses Dr. Abrouk taught two graduate statistics courses at the Indianapolis and Bloomington sites of the Engineering Management program. He published a paper entitled "Approximation of Distribution Laws in Population Genetics Governed by Fokker-Planck Equations" in the AJSE journal, refereed. Dr. Abrouk's presentations included "Statistical Models for Engineering Metrology" at the American Society of Quality (ASQ) and "Statistical Models for Measurement Systems" at the American Statistical Association, Indianapolis (Eli Lilly). As director of the Center for Industrial Statistics he carried out projects in MAPP: Midwest Association of Plastics Partners and Cadillac Products. He also submitted proposals

for the Foundation Coalition and the Engineering Management Program. Dr. Abrouk is also the co-advisor for a Master level student.

George Berzsenyi continued to work with the USA and International Mathematical Talent Searches (USAMTS and IMTS) in an advisory capacity and as the creator/selector of the problems used in these programs. He also found a successor to his editorial work on the IMTS column in *Mathematics and Informatics Quarterly*, though the transition is still in progress. Hence, he is still involved with a fair amount of “ghost-writing”. He also continues to serve on the Editorial Board of *Quantum, Mathematics and Informatics Quarterly* and *Math Horizons*, as well as various series of other publications. Recently, he also prepared two articles for *ARMLog*, the newsletter of the American Regional Mathematics Competitions, and he is presently writing a lengthy Preface to a new book of nearly 800 problems originally published in Hungary's high school mathematics journal during the second century of that journal. The preliminary edition of this book will be prepared specifically for the winners of the USAMTS. In order to prepare a book on the first eight years of the USAMTS and to pursue other writing projects, Professor Berzsenyi requested and received a leave of absence for the 1998-99 academic year. He hopes to publish at least two books of problems (and solutions, etc.) during his leave.

Allen Broughton, in addition to his duties as teacher and department head, put in a robust year of grant writing and presentations centered on undergraduate research and enhancing the institute's computing infrastructure. Along with John Rickert and Gary Sherman he was successful in getting an additional three years of funding for the NSF-REU in Computational Group Theory and Hyperbolic Geometry. As a follow-up he delivered three talks on undergraduate research at RHIT at Wabash College, the winter AMS meetings in Baltimore, and Cleveland State University. In the area of computing infrastructure, in collaboration with Frank Young, he submitted an ILI proposal, contributed to a proposal to the Kresge Foundation, and two Lilly Foundation pre-proposals. He was also a member of the Laptop Committee and the Academic Computing Committee. He organized a number of presentations by faculty of use of the laptop computer in various courses including a presentation at the IHETS Conference on Technology in Education at Purdue. Finally, he gave a series of talks on wavelet based methods in image processing in the Applied Math Seminar.

Kurt Bryan, with co-author Lester Caudill at the University of Richmond, wrote a paper “Stability and Reconstruction for an Inverse Problem for the Heat Equation”, which was submitted to the Journal of Inverse Problems. The research was funded by a grant through the Mathematical Sciences Division of the NSF. Bryan and Caudill also organized a mini-symposium on “Inverse Problems and Nondestructive Testing” for the upcoming SIAM national meeting in July. Professor Bryan has continued as the organizer of the weekly Applied Math Seminar, which ran during the winter and spring. Seven talks on “Wavelet Applications in Image Processing” were given by Allen Broughton, and Kurt Bryan presented six lectures on “RSA Cryptography.” Professor Bryan attended the joint national meetings of the MAA and AMS in Baltimore in January and gave a talk on “Integrating Vector Calculus and Electromagnetics in a Freshman Course”, related to material he developed and taught in the Integrated Curriculum. With Yosi Shibberu he organized this year's Undergraduate Mathematics Conference, which ran on March 13 and 14, 1998. He also refereed several papers for SIAM journals and PRIMUS.

Stephen Carlson is serving the Indiana Section of the Mathematical Association of America (MAA) as its Past-Chair, and he attended the Spring 1998 Section Meeting which was held at Ball State

University in March. He also serves the MAA as a member of the national Committee on Sections, and he attended the national meetings of the MAA, held jointly with the American Mathematical Society, in Baltimore during January.

In addition to meetings of professional societies, Carlson attended the Undergraduate Mathematics Conferences held at Miami University (Oxford, Ohio) in September and at Rose-Hulman in March. He served as the advisor and coach for the Rose-Hulman team entered in the 1997 Putnam Competition, and he has continued his reviewing work for the international mathematical abstracts resource "Zentralblatt fur Mathematics." He has also resumed his position as RHIT coordinator for the ISU-RHIT-SMWC Mathematics Colloquium series.

Elton Graves, in addition to his normal teaching, conducted an independent study course with two students. Outside of the classroom, Professor Graves continues to serve the Institute as Chair of the Admissions and Standings Committee, the Mathematics representative to the Faculty Affairs Committee, a member of the Laptop Committee, and a member of the Mathematics Department's Curriculum Committee. As the advisor to Pi Mu Epsilon, the Mathematics honorary, Professor Graves organized the annual banquet at which 31 new members were inducted into the honorary. Professor Graves also serves as the Director of Fast-Track Calculus, one of our most successful programs for entering freshman. He oversaw the application and selection process of the more than 60 students who applied to participate in Fast-Track Calculus. Fast-Track Calculus will start on July 19 and run through August 21. Professor Graves will be joined by Professor Lautzenheiser in the teaching of Fast-Track Calculus this year.

In the area of professional activity Professor Graves attended the Spring Section Meeting of the Indiana Section of the MAA held at Ball State University. In addition, Professor Graves continues as the State Director of the AJHSME and AHSME (American Junior High School Mathematics Exam & American High School Mathematics Exam.) This year Indiana had almost a 10% increase in the number of schools participating in the AHSME (150 total). This puts Indiana in the top ten in the nation in number of schools that participate in the AHSME.

Professor Graves is also a member of the Executive Advisory Committee to the MAA's Committee on Mathematics Competitions. Professor Graves has been invited to help train new State Directors for the AJHSME and AHSME at a special meeting of the CMAC to be held in Lincoln, Nebraska, in June. He also continues to serve as a member of the Board of Directors for the Mathematics Division of ASEE.

Ralph Grimaldi taught courses in discrete mathematics, calculus, and statistics and served as the course coordinator for Discrete and Combinatorial Algebra I and for Engineering Statistics. He attended the Midwest Conference on Combinatorial Mathematics in October and was the coordinator of this year's Rose-Hulman high school mathematics contest (for over 540 participants) in November. In January, Professor Grimaldi attended the national mathematics meetings in Baltimore where he delivered the MAA mini-course on Fibonacci and Catalan Numbers. This past March he attended the 29th International Conference on Combinatorics, Graph Theory and Computing at Florida Atlantic University where he chaired a session on graph theory and presented the paper "The Catalan Numbers as a Sum of Squares". The paper "A Tennis Ball Problem and the Catalan Numbers", which he presented at last year's conference and which was co-authored with Professor Joseph Moser, a Rose-Hulman graduate of the 1950's, was published in *Congressus Numerantium* this past December. In addition, during the school year Professor Grimaldi served on the First Year Team, was the department representative to the Committee on Leaves, and continues to serve on the search committee for new faculty.

Matthew Hopkins assisted in running the RHIT High School Math competition and the laptop orientation classes. He attended the fall meeting of the Indiana Section of the Mathematical Association of America at Wabash College. He served on the department's computing committee. During the spring he attended a conference on Iterative Methods in Colorado. He has been invited to an IMA workshop on biological fluids to take place next January. Dr. Hopkins has been invited as a visiting faculty researcher for this coming summer, at Sandia National Labs in Albuquerque, New Mexico. Dr. Hopkins is the new faculty advisor for the recently established paintball club.

Aaron Klebanoff became a member of the executive board of the Indiana Section of the Mathematical Association of America as the new Student Chapter Coordinator. As calculus coordinator, he helped to coordinate the calculus syllabus with the physics courses, and he also guided the department in adopting a new calculus text. In November, he presented a talk at the International Conference on Technology in Collegiate Mathematics held in Chicago, Illinois on teaching with laptop computers. During winter quarter, he attended an imaging short course in Baltimore, and he also advised three modeling teams in Rose-Hulman's best overall performance ever for the Mathematical Contest in Modeling. During spring quarter, he organized and ran the Indiana College Math Competition at Ball State University in Muncie. Dr. Klebanoff was also very active on the Honors and Awards Committee and played a key role at the awards ceremony as well as helping the math department determine this year's award winners. In May, collaborative work with Professor John Rickert on "Studying the Cantor Dust at the Edge of Feigenbaum Diagrams" appeared in the College Mathematics Journal.

Lynn Kiaer is completing her fourth year of teaching in the integrated First Year Curriculum in Science, Engineering and Mathematics (IFYCSEM). In addition to teaching in the IFYCSEM, she taught MA 215 (Discrete and Combinatorial Algebra I) in the fall term, MA 444 (Deterministic Models in Operations Research) in the winter term, and is teaching MA 490 (Simulation) in the spring term. She also taught two special topics/independent study courses during the past academic year. Besides teaching activities, she attended the Institute for Management Science and Operations Research (INFORMS) meeting in April, and presented a paper on her timetabling research. The most visible result of her research has been the implementation of her scheduling algorithms in the development of the Rose-Hulman final exam scheduling process. She has been invited to submit a paper on this timetabling research to *Interfaces*, the flagship applications journal of INFORMS. Recent work with a consulting client on physician's on-call scheduling has resulted in summer support for the summer of 1998. Dr. Kiaer is the section chair for the mathematics section of the ASEE.

John Kinney received a grant from the Indiana State Department of Education to conduct a two-week summer program for middle and secondary school teachers. The purpose of the grant is to provide instruction in probability, statistics, and discrete mathematics so that teachers may incorporate topics from these areas into existing courses as well as develop individual courses devoted to these areas. Separate courses in probability and statistics as well as a course in discrete mathematics are now approved for inclusion in our secondary Core 40 curriculum. (Kinney has served on the mathematics group developing the Core 40 curriculum.) The grant provides for released time for the entire academic year so that Kinney can work with the teachers in the program. He also attended a meeting on Statistics for Correlated Data at Iowa State University in October and he spoke to the Indiana Council of Teachers of Mathematics that month as well. In March he presented a paper on Mathematica in Courses in Probability and Statistics at the Western Statistics Teachers Conference in Colorado

Springs. He continues to spend some time with the Commission on Assessment and other Institute committees as well.

Robert Lopez served as Freshman Advisor to 23 Fast-Track Calculus students. At the start of the academic year, he signed a contract with Addison-Wesley Publishers to write an Advanced Engineering Mathematics text. He serves as Secretary/Treasurer of the Math Division of ASEE, and is a member of the NSF review panel for the RPI Project Links. Dr. Lopez published, in MapleTech, a third article in the Tips for Maple Instructors column, spoke at an AMS meeting at Georgia Tech, and at an NSF conference on assessment of Maple in teaching calculus. In addition, Dr. Lopez was a beta-tester of the newest release of the Maple software.

David Rader, in his first year, participated in a number of on-campus and off-campus professional activities. He was an instructor during the freshman Laptop Orientation in the fall and also helped with both the Virginia Tech Regional Mathematics Contest and the RHIT High School Mathematics contest. He was also involved in the department's computing services committee. In addition, he attended the fall meeting of the Indiana Section of the Mathematical Association of America at Wabash College. He presented the paper "Maximizing the Product of Two Linear Functions in 0-1 Variables" at both the RHIT/ISU/SMWC Joint Colloquium at RHIT and at the INFORMS Fall 1997 meeting in Dallas. At that same INFORMS meeting, he also presented the paper "Lifting Results for the Quadratic 0-1 Knapsack Polytope." In the spring of 1998, he presented the paper "Maximally Disjoint Solutions of the Set Covering Problem" at the INFORMS meeting in Montreal, Quebec. During the 1997-1998 academic year, his paper "Efficient Methods for Solving Quadratic 0-1 Knapsack Problems", written with Peter L. Hammer of Rutgers University, was published in INFOR, the Canadian Operational Research Society Journal. He also wrote and submitted three other papers to journals. In addition, he refereed papers for the journal, Discrete Applied Mathematics.

Gary Sherman continued to work on his idiosyncratic text "Indiscrete Discrete Mathematics" and talked and visited with faculty from around the country who are interested in how he engages students in undergraduate research (including an academic year research project on Cwatsets) and how he uses technology in discrete mathematics and abstract algebra (including three talks at West Point, one talk at the University of St. Louis, and three talks at the North Dakota State University). In addition to organizing Differential Equations I and II, he served as Faculty Representative to the Academic Affairs Committee of the Board and on the Vice-President for Academic Affairs Search Committee, and chaired the Mathematical Association of America's Allendoerfer Award Committee.

Professor Shibberu gave an invited talk on Discrete Mechanics at the University of Missouri in Rolla. He was one of the co-organizers of the Freshman Math Competition and the Rose-Hulman Undergraduate Math Conference. This year Professor Shibberu served as the mathematics advisor for junior math majors and as chair of the Math Department's Curriculum Committee. He also served as secretary of the Student Affairs Committee and continues to serve as faculty advisor for the Rose-Hulman Chapter of the National Society of Black Engineers. Professor Shibberu served as a member of the Education Committee of the Terre Haute Branch of the NAACP. He continues to be active as an advisor and Saturday morning tutor in the Eli Lilly sponsored Academic First Program as well as serving as a judge for several high school science fair projects.

AJSE journal.

Kurt Bryan and Lester Caudill, “Stability and Reconstruction for an Inverse Problem for the Heat
submitted to the Journal of Inverse Problems.

Ralph Grimaldi and Joe Moser (Rose alum, 1950's) “A Tennis Ball Problem and the Catalan
, Congressus Numerantium.

Ralph Grimaldi et al. “A Tiling Scheme for the Fibonacci Numbers”, *Journal of Recreational Mathematics.*

Aaron Klebanoff and John Rickert, “Studying the Cantor Dust at the Edge of Feigenbaum
Diagrams”, *College Mathematics Journal.*

Lynn Kiaer, Jeff Froyd and David Mutchler, “Laptop Computers in an Integrated First Year
Curriculum”, *Communications of the ACM.*

David Rader and Peter L. Hammer, “Efficient Methods for Solving Quadratic 0-1 Knapsack
INFOR (a journal of the Canadian Operational Research Society).

Robert Lopez, “Tips for Maple Instructors”, *MapleTech.*

Gary Sherman, S. Ahearn and M. Huber, “Finite Groups can be Arbitrarily Hamiltonian”,
Communications in Algebra.

PRESENTATIONS, SEMINARS and COLLOQUIA

Off campus presentations:

Nacer Abrouk, “Statistical Models for Engineering Metrology” *American Society of Quality (ASQ)*

_____, "Statistical Models for Measurement Systems", *American Statistical Association, Indianapolis (Eli Lilly)*.

Allen Broughton, "Tilings, Finite Groups, and Hyperbolic Geometry at the Rose-Hulman REU", *MAA Fall meeting, Wabash College*.

_____, (with Sam Hulbert, Julia Williams, Ed Doering), "The role of technology in enhancing learning in various disciplines", *IHETS Purdue Conference on Technology Enhancement and Teaching and Learning*.

_____, "Undergraduate Research at the Rose-Hulman REU - What Works for Us", *AMS Annual meeting, Baltimore*.

_____, "Tilings, Finite Groups, and Hyperbolic Geometry at the Rose-Hulman Rose-Cleveland Topology Seminar

Kurt Bryan, "Calculus and Electromagnetics in a Freshman Course", *AMS Annual meeting, Baltimore*.

Ralph Grimaldi, MAA mini-course on "Fibonacci and Catalan Numbers", *AMS Annual meeting, Baltimore*.

_____, "The Catalan Numbers as a Sum of Squares", *29th International Conference on Combinatorics, Graph Theory and Computing at Florida Atlantic University*.

Aaron Klebanoff, "Laptops, Bloody Laptops", *International Conference on Technology in Collegiate Mathematics, Chicago*.

Lynn Kiaer, "Practical Timetabling" *Institute for Management Science and Operations Research (INFORMS), Montreal*.

John Kinney, "Mathematica in Courses in Probability and Statistics" *Western Statistics Teachers Conference in Colorado Springs*.

Robert Lopez, "Vignettes: Maple in the DE Classroom", *AMS meeting at Georgia Tech*

_____, "Maple-Calculus Assessment Project: RHIT Expressions", *NSF conference on assessment of Maple in teaching calculus*.

David Rader "Maximizing the Product of Two Linear Functions in 0-1 Variables", *INFORMS Fall 1997 meeting in Dallas*.

_____, "Lifting Results for the Quadratic 0-1 Knapsack Polytope", *INFORMS Fall 1997 meeting in Dallas*.

_____, "Maximally Disjoint Solutions of the Set Covering Problem", *INFORMS meeting in Montreal*.

Gary Sherman, "Introducing ...Cwatsets!", *University of St. Louis (1 talk)*

_____, a series of six talks on how Dr. Sherman engages students in undergraduate research (including an academic year research project on Undergraduate Research in Cwatsets) and how he uses technology in discrete mathematics and abstract algebra, *West Point (3 talks) and North Dakota State University (3 talks)*.

Yosi Shibberu, "Discrete Mechanics", *University of Missouri in Rolla*

On Campus Presentations

RHIT/ISU/SMWC Joint Colloquium

David Rader, (RHIT), "Maximizing the Product of Two Linear Functions in 0-1 Variables",

Krzysztof Podgorski, (IUPUI), "Exact Distributions for Waves in a Gsussina Sea"

Robert Foote, (Wabash College). “Planimeters and Isoperimetric Inequalities on Constant Curvature

Applied Math Seminar

Allen Broughton, “Wavelet based Methods in Image Processing”, 7 talks

Kurt Bryan, “RSA Cryptography”, 6 talks

PROGRAMS and CONFERENCES (more details of programs in various locations above)

32nd Rose-Hulman High School Mathematics Contest This contest brought over 540 high school participants onto the RHIT campus, a record attendance. Counting all sites there are over 2,000 participants. Organizers: Herb Bailey (problems), Ralph Grimaldi, Lynn Kiaer, Dave Rader, and Matt Hopkins.

The Fifteenth Annual RHIT Undergraduate Mathematics Conference, organized **Kurt Bryan** and **Yosi Shibberu**, was very successful, with about 70 participants, some as far away as Tuscon, Arizona. The invited speakers this year were Charles Groetsch, University of Cincinnati and Ed Packel, Lake Forest College, who together made 3 presentations, in addition to the 12 student talks.

The **Fast Track Calculus** program this year continues to attract record numbers of applicants (72 this year). Fifty-four students have been invited to participate and enrollments are expected to be in the 40-50 range. Professors **Elton Graves** and **Roger Lautzenheiser** will be teaching in this summer’s program which begins July 19.